

REMARKS

Claims 11-21 remain in this application.

Some minor grammatical errors were noted in claims 20 and 21, which errors have been corrected by this amendment.

In the Final Office action of May 13, 2008, the examiner rejected claims 11-20 as unpatentable over Tsumura et al in view of Schechter et al, and claim 21 as unpatentable over Tsumura et al in view of Schechter et al and Benson.

It is applicant's strong belief that the examiner is still misreading the disclosure of Tsumura et al.

First, in Tsumura et al the examiner calls element 22 an "outer piston". However, contrary to the examiner's reading, element 22 of Tsumura et al is integral with and is directly actuated by the stem 38. As shown by Tsumura et al, elements 38 and 22 are integral. They are one and the same element, and form the pump piston which compresses the fuel gas mixture in chamber 24 as actuator 14 pushes them downwardly.

Element 22 of Tsumura et al is not actuated by a "second control chamber (20)" as recited in claim 11 at lines 8-9. Piston 22 of Tsumura et al is acted on and is actuated only by its mechanical connection through stem 38. Stem 38 is in turn operated by rocker arm 52 of mechanism 14, plus spring 44. Thus, as mechanism 14 of Tsumura et al is actuated, piston 22 will be operated by its direct mechanical connection to actuator 14, not by means of a control chamber.

Contrary to the examiner's reading of Tsumura et al, element 22 of Tsumura et al is not in any way actuated by chamber 68.

The accurate explanation is that piston 22 is forced downwardly by mechanism 14 and stem 38. As this happens, the movement of piston 22 creates or opens chamber 68. As chamber 68 opens it provides a space for the contents of chamber 62 to enter so that pressure in chamber 62 will not build up and force piston 60 to extend into combustion chamber 88 prematurely.

In Tsumura et al injection needle 60 is intended to extend into the combustion chamber and thus open the injection openings only when plunger top 74 is engaged by piston 22 at the top of chamber 62. By a direct mechanical engagement as shown in figure 2, piston 22 forces injection needle 60 downwardly to extend its nose 76 into the combustion chamber and thus open spray holes 80. This operation is described by Tsumura et al at column 4 lines 23-30 and column 3 lines 30-51.

Contrary to the examiner's reading as expressed at lines 9-11 of page 3 of the action, "chamber" 26 is not a second control chamber that actuates the outer piston. Tsumura et al clearly disclose the chamber 26 to be an inlet, an area from which fuel enters the compression chamber 24. Neither chamber 24 nor 26 exerts any control over, or in any way actuates, the outer piston. Outer piston 22 of Tsumura et al is controlled exclusively by mechanism 14 through rocker arm 52 and stem 38, which stem 38 is in fact integral with piston 22.

In further support of this reading, Tsumura et al shows four unnumbered seals which surround and seal piston 22 and seal it within bore 20. In view of these four seals, chamber 68 is

precluded from being hydraulically connected to or actuated by "chamber" 26. Piston 22 is lowered by stem 38, and as this happens chamber 68 opens, thus providing a space for the contents of chamber 62 to enter so that pressure in chamber 62 will not build up and force piston 60 to extend into combustion chamber 88 prematurely.

In Tsumura et al the inner needle part 60 is actuated by direct contact with piston 22 as it is pressed downwardly by stem 38. This is clearly shown in figure 2 and is described in column 4. As outer piston 22 mechanically engages inner needle 60, it pushes against the inner needle 60 so as to make the inner needle 60 move downwardly until nose 76 projects out from nozzle tip 18 and into combustion chamber 88. This opens spray nozzles 82 so that the air/fuel mixture which is created and pressurized by piston 22 within pre-mixing chamber 24 can be sprayed into combustion chamber 88.

In Tsumura et al there is no second booster chamber hydraulically connected to any first control chamber which actuates the inner needle part, contrary to what is recited in claim 11.

And contrary to what the examiner has expressed at lines 12-13 of page 3 of the action, 28 is not a first "control chamber." It is only a "chamber" where air waits to be admitted into pre-mixing chamber 24. Because of the four seals which surround piston 22, "chamber" 28 cannot be hydraulically connected to chamber 62.

Furthermore it is pointed out that in the Tsumura et al reference, the injector belongs to a "pumpe-Duse-Einheit" (unit injector), in which the injection pressure is generated by the unit itself, not by a pressure reservoir (common rail) as in the injector of the present invention. Thus

the piston 22 in Tsumura is part of the fuel pump. In fact, piston 22 is the pump piston in Tsumura et al. It is driven by the cam 52 and generates the injection pressure within chamber 24. Consequently the piston 22 cannot be an external needle as well. The injection valve member in Tsumura et al is a one piece valve member, it has only one needle, namely the needle 60.

In his rejections the examiner has combined the Schechter et al reference with the Tsumura et al reference. But there is no structure in Schechter et al which overcomes the fact that the above features are lacking from Tsumura et al. Schechter et al do teach an injection system with an injector at 18, 22. But Schechter et al do not teach any of the structure which, as pointed out above, is not present in Tsumura et al. Schechter et al do not teach a hydraulic booster assembly actuated by the actuator. Schechter et al do not teach first and second control chambers for actuating the valve member. Schechter et al do not teach a first booster chamber hydraulically connected to a second control chamber that actuates the outer needle part. Schechter et al do not teach a second booster chamber hydraulically connected to the first control chamber that actuates the inner needle.

The Tsumura et al and Schechter et al references simply do not meet all the limitations of claim 11 and the claims which depend on it.

Furthermore, "outer piston" 22 of Tsumura et al does not open or close an injection valve port. Rather, as it is pushed by stem 38, the outer piston of Tsumura et al closes inlets 26 and 28, and it is a pump piston which then compresses the mixture within chamber 24.

Wording the situation somewhat differently, in Tsumura et al, there is no chamber which

can be considered to be a first booster chamber. There is no second control chamber which actuates the outer needle part as recited in claim 11, in Tsumura et al the outer needle part 22 is actuated by the stem 38 and rocker arm 52. Since there is no first booster chamber and no second control chamber in Tsumura et al, there can be no hydraulic connection between them as recited in claim 11.

Likewise in Tsumura et al, there is no chamber which can be considered to be a second booster chamber, and there is no first control chamber which actuates the inner needle part as recited in claim 11, since in Tsumura et al the inner needle part 60 is actuated by physical engagement of its end 74 with needle 22. Since there is no second booster chamber and no first control chamber in Tsumura et al, there can be no hydraulic connection between them, as is recited in claim 11.

The part which the examiner has looked at in Tsumura et al as the outer needle is part 22. But this part 22 is integral with stem 38, and is actuated there-through by rocker arm 52. Claim 11 recites "a multi-part injection valve member having an inner needle part and an outer needle part". The outer part 22 of Tsumura et al closes off inlets 26 and 28 and so may be considered to be a valve, the injection valve of Tsumura et al is the inner part 60. It is this inner part 60 which controls the injection openings 80. Contrary to what is recited in claim 11, inner part 60, the injection valve, is not a multi-part member having an inner needle part and an outer needle part. Part 22 of Tsumura et al does not cover or uncover any injection openings as required by the language of claim 11 by the fact of the outer part being part of a multi-part injection valve.

Furthermore, the Tsumura et al reference does not disclose a fuel injector whose injection valve member has two needle parts. The sole needle part of the injection valve member of the Tsumura et al reference is element 60. This is the only needle part which acts to open and close injection openings 80. The outer piston 22 acts neither to close, nor to open injection openings, and in this respect is not a needle part of an injection valve.

The outer piston 22 of Tsumura et al, in contrast to being a nozzle needle which opens and closes injection ports, performs the task of sliding down around needle part 60, and in so doing it compresses the mixture in pressure chamber 24 to a point where, as outer part 22 continues downwardly sufficiently, it pushes nozzle needle 60 until reduced diameter section 76 extends through bore 78, at which time the air-fuel mixture compressed in chamber 24 is expelled through the nozzle needle passage 82 and spray holes 80. Outer part 22 is a pressure piston of the fuel pump. It generates the injection pressure by reducing the size of the premixing chamber 24. It is not a needle which opens and closes injection openings.

The Schechter et al reference also does not disclose a fuel injector having two needle parts guided coaxially one inside the other. Thus, the Schechter et al reference cannot be combined with the Tsumura et al reference to provide a valid rejection of the claims, since neither reference teaches the structure which is recited by claim 11 and the claims which depend on it. For this reason, as well as the reasons given above regarding the Tsumura et al reference, the combination of the Tsumura et al and Schechter references does not make a proper combination for the rejection of applicant's claims. This combination of Tsumura et al and

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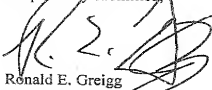
Schechter et al simply does not meet all of the limitations of the claims.

Benson does not remediate any of the issues presented by the other references and thus adds nothing of substance to the already deficient teachings cited by the examiner in the Tsumura et al and Schechter references.

Appl. No. 10/576,070
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For all of the above reasons, taken singly or in combination, entry of the amendment and allowance of the claims are courteously solicited.

Respectfully submitted,



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